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THE NATIONAL ARCHIVES AND THE ADVANCEMENT OF SCIENCE[1]

By Dr. SOLON J. BUCK

DIRECTOR OF PUBLICATIONS IN THE NATIONAL ARCHIVES

IT may be assumed that no explanation of the phrase "advancement of science" will be needed before this audience, though notice should perhaps be given that the word "science" as here used includes history and the social sciences. The word "archives," however, seems to have only a very vague connotation to most people and needs definition. The word is derived from the Greek *Archeion,* which means government house, and was at first applied only to the records and papers of a governmental agency. By analogy, however, it has come to be used for the accumulated files of an institution, a firm or even a family; but it should never be used with reference to a collection of historical documents, no matter how valuable they may be, that have been assembled by an agency rather than produced or received in the course of the transaction of its business or that of the government or institution of which it is a part. The term is not properly applied, moreover, to individual documents, but only to the entire mass or collection of records of a government or institution or one of its subdivisions. The singular form "archive" is not ordinarily used in English and should never be applied to a single document.

The national archives, therefore, comprise the sum total of documents, records and papers made or re-

[1] Address of the retiring vice-president and chairman of Section L—Historical and Philological Sciences, American Association for the Advancement of Science, St. Louis, January 2, 1936.

ceived in the transaction of public business by an official or agency of the national government and filed for preservation by or for the official or agency concerned. They include the papers of yesterday as well as those of a hundred years ago, inconsequential items as well as momentous documents, correspondence as well as treaties and statutes, typescripts as well as manuscripts, and in fact printed items if they have been filed for record purposes. There is no justification for the use of the word "archives" in the sense of old documents of special historical interest in contradistinction to files of papers concerned with the everyday transactions of the government. The expression "The National Archives" has recently acquired another meaning, however: It is the official name of the institution that has been created to have the custody of a part of the national archives in the other sense, especially that part that is no longer in current use in connection with the activities of the agency in which the documents were produced or received. Confusion between the two meanings of the expression can be avoided in writing by using capitals only when referring to the institution. This paper is concerned both with the national archives as a body of records and with The National Archives as an institution.

The history of the national archives is coeval with that of the nation. The records and papers of the Continental Congress, which were carefully preserved by its secretary, Charles Thomson, were properly transferred to the custody of the new government set up under the Constitution in 1789. Apparently little attention was paid to them until 1810, when a special committee of the House of Representatives, headed by Josiah Quincy of Massachusetts, reported that they were "in a state of great disorder and exposure; and in a situation neither safe nor convenient nor honorable to the nation." The committee recommended "the building of, at least, three additional fire proof rooms, within the building west of the President's house" to house these papers and the accumulating records of the State, War and Navy Departments; and Congress made an appropriation for the purpose.

Unfortunately this first "Archives Act" did not serve as a precedent for further legislation. Government agencies multiplied and their archives increased by leaps and bounds, but for over a century no archives legislation of a general character was enacted by Congress. Each bureau or office, as a rule, retained the custody of its own archives, non-current as well as current; though there was some concentration into departmental collections, notably in the State and War Departments; and a few groups, including the papers of the Continental Congress, were transferred to the Library of Congress. The bureaus, as a rule, manifested little interest in the non-current papers, and many of them were stored under conditions that resulted in their loss or irreparable damage by fire, water, vermin or thieves. In the period from 1873 to 1915 no less than 250 fires occurred in government offices in Washington, in many of which valuable records were destroyed. Vast quantities of older papers were also disposed of by officials to make room for expanding activities, often with little or no consideration of the possible value of these papers for historical or even for administrative purposes.

The problems involved in this situation were first brought formally to the attention of Congress in 1877, when President Hayes, in a special message, asserted that "the records of the Government constitute a most valuable collection for the country, whether we consider their pecuniary value or their historical importance" and urged legislation to prevent "their destruction or damage by fire." In 1878 and again in 1879 Hayes recommended "the construction of a cheap and perfectly fireproof building" for "the safe storage" of the records. Two fires that occurred in the War Department in 1880 and 1881 were probably responsible for the passage of an archives bill by the Senate in the latter year, but the House took no action. Again and again during the next thirty years the construction of an archives building was recommended by Presidents and cabinet officers and bills were introduced and sometimes passed by one house, but no law was enacted.

The prevalent conception of an archives establishment during most of this period was that of a warehouse for the storage of the records, and little consideration was given to problems of accessibility and administration. Historical scholars were beginning to bestir themselves, however. In 1899 the American Historical Association created its Public Archives Commission, which began to study and report upon archival problems and in 1909 inaugurated an annual "Conference of Archivists"; in 1904 the Carnegie Institution of Washington published the first edition of its invaluable *Guide to the Archives of the Government of the United States in Washington;* and scholars familiar with the opportunities for research in European archives began to ask why similar opportunities were not available in this country. As a result of continued discussion and agitation, it became clear that the primary reason for preserving the archives was to have them available to officials or scholars who might have occasion to consult them for administrative or scientific purposes and that a mere warehouse, no matter how safe, would not serve this purpose.

This new conception of an archives establishment as a functional agency and the realization that the records of the government had a scientific as well as an administrative and a sentimental value gave added

impetus to the movement for legislation, and in 1913 Congress authorized a study of European archives establishments and the preparation of plans and specifications for a fireproof building to cost not more than $1,500,000. The next few years were not propitious for an inspection of archives establishments in Europe, and the entrance of the United States into the world war shelved the project for the time being. After the war was over there were further delays, due in part to disputes over the site for the proposed building. In the meantime, however, records and papers accumulated at a greatly accelerated pace, the offices in Washington were overwhelmed by the problem of finding space for them, and the conception of the proposed establishment was further expanded. Finally in 1926 Congress appropriated $6,900,000 for an archives building, the site was selected, and intensive work was begun on the preparation of plans and specifications. The appropriation was increased to $8,750,000 in 1928, ground was broken in 1931, the corner-stone was laid in 1933, and the building, though still incomplete in some respects, was turned over to the government in November, 1935. It is expected that the transfer of records and papers will begin in the near future and that the building will be dedicated by President Roosevelt in the spring.

The National Archives Building of the United States is unquestionably the finest and best-equipped structure of its kind in the world. The delays made possible a thorough study of the problems involved, including the long-postponed inspection of European establishments; and the architects were thus prepared to avoid the mistakes of others and to take advantage of the latest developments in construction and equipment. Their fundamental objectives were to provide for the safety of the records and to make them as readily accessible as would be consonant with safety. The greater part of the building consists of a huge rectangle containing twenty-one levels of stacks and divided by fire walls and concrete floors into sections, each of which is three levels high and contains an office for a section chief. Each section is in fact an air-conditioned vault with temperature and humidity under complete control and fully equipped with devices for detecting fires or unauthorized entry. The stacks are of steel and are equipped with removable steel containers of convenient sizes for the storage of the documents. Completely separated from the stack area are an impressive exhibition hall on the front or Constitution Avenue side and the administrative offices, search rooms and reference library on the Pennsylvania Avenue side. The receiving room and the quarters for the cleaning, fumigation and other conditioning of the documents are in the basement, and a projection room and storage vaults for motion picture films and sound recordings are on the fifth floor.

The National Archives as an institution was created by act of Congress in June, 1934. The act provides for the appointment of an archivist by the President, with the advice and consent of the Senate, and sets up a National Archives Council, composed of the members of the Cabinet or their representatives, the chairmen of the Senate and House committees on the library, the Librarian of Congress, the secretary of the Smithsonian Institution and the archivist. To this council are given the functions of defining the classes of material to be transferred to the building and advising the archivist with reference to the disposition and use of the material transferred. To the archivist is given authority to make appointments to the staff (with the exception that all employees receiving a salary of five thousand dollars or over must be appointed by the President and confirmed by the Senate), "to inspect personally or by deputy the records of any agency" of the government, "to requisition for transfer" material within the classes designated by the council, and "to make regulations for the arrangement, custody, use, and withdrawal" of deposited material. The act also creates a National Historical Publications Commission consisting of the archivist and representatives of the State, War and Navy Departments, the Library of Congress and the American Historical Association, which is directed to "make plans, estimates, and recommendations for such historical works and collections of sources as seem appropriate for publication . . . at the public expense." The recommendations of this commission are to be transmitted to Congress by the archivist. The National Archives is further authorized to "accept, store, and preserve motion-picture films and sound recordings" of historical interest and to maintain a projection room "for historical purposes and study."

For the position of archivist, the President, on the recommendation of representatives of the American Historical Association, selected Dr. R. D. W. Connor, professor of history in the University of North Carolina, who had served for many years as the archivist of North Carolina. The appointment was made in October, 1934, and Dr. Connor proceeded to plan the organization and assemble a skeleton staff. The activities of the institution were classified in four groups, two having to do mainly with internal administration and two concerned primarily with external relations. Under the executive officer are the usual business divisions and, in addition, a division of photographic reproduction and research, which will play an important part in making the documents available to scholars throughout the country and may help to solve the problem of bulk by the use of micro-photography.

Under the director of archival service are the divisions of accessions, repair and preservation, classification, cataloging, departmental archives, maps and charts, reference, research, the library, motion pictures and sound recordings, and the *Federal Register*. The last of these is a division created by a special statute to receive from the various agencies of the government and to publish daily all proclamations and executive orders of general applicability and legal effect. The administrative secretary is charged with the conduct of official relations with agencies of the government and the public, including general correspondence, the supplying of general information to the public, the preparation of data for annual reports and budgets and the arrangement of exhibitions. He will also serve as secretary of the National Archives Council. The director of publications will be expected to compile and edit the official reference publications of The National Archives, such as guides, inventories and calendars; and, as secretary of the National Historical Publications Commission, to make plans and estimates for and to have general editorial supervision over the publications recommended by the commission and authorized by Congress.

Only a very superficial examination of the records and papers in the national archives is necessary to convince one that they are of inestimable value for purposes of scientific research. Moreover, in spite of the vast number of government publications, only a small proportion of the material of importance is available in print. The most obvious significance of the archives in relation to science, of course, is in the domain of history. Though it is generally recognized that they are "the first and foremost of all the sources of the Nation's history," the use that has been made of them by historical scholars is astoundingly small. They have long been recognized as essential to any thorough investigation in the political, diplomatic, administrative and legal history of the United States, but they have been so difficult to use that scholars have contented themselves, as a rule, with the incomplete and often unreliable material available in print. Their value for economic and social history has been considerable from the first and has been greatly increased in recent years as a result of the expansion of the activities of the federal government. Next to history, the social sciences could profit most by a greater use of the material in the national archives for research. The records of the activities of the government in its many manifestations are obviously raw materials for the student of political science, and their use in complete form instead of in fragmentary printed versions would in many cases enable him to get below the surface. Many data are accumulated by government agencies that bear upon the life of the people in their economic and social relations. Use is made of these data, of course, by the agencies concerned, and the results are usually published; but every scholar knows that data assembled for one purpose or in one connection are frequently of inestimable value in another connection.

That the government is engaged in a wide variety of research activities in the field of natural sciences is well known, and a number of those activities are being reported on or illustrated by exhibits at this meeting of the American Association for the Advancement of Science. Most of the discoveries and achievements are made known promptly to the scientific world, of course, but some of them, designed primarily for the use and benefit of the government itself, receive little or no publicity. The value for the history of science of the original records of scientific agencies of the government, some of which go back to a very early day, is obvious, of course; and here again there is always the possibility that observations recorded and data accumulated for one purpose may be useful for quite a different purpose. It has sometimes happened, moreover, that experiments and investigations have had to be discontinued because of failure of appropriations or change of policy before they could be completed, or funds have been lacking for the publication of the results achieved. In such cases, presumably, the data recorded or reports prepared, or both, have been filed away; and, if they could be made known and accessible to other investigators, either in or outside the government service, they might ultimately serve their original purpose.

It is hopeless, in view of the present condition of the national archives, to attempt any comprehensive survey of the materials in them of value for scientific research. Perhaps five or ten years from now, when the non-current archives may have been transferred to the custody of the archivist, classified and inventoried, and more space has thereby been made available for the better care of current records, a guide or series of guides can be prepared to all the material of interest to scientific investigators, with the information classified by sciences. A comprehensive presentation of the pertinent information now available in existing guides or to be inferred from knowledge of activities of government agencies would be impossible within the limits of this paper, but it may be useful to present some fragmentary memoranda concerning material in the archives of selected agencies of the government.

The State Department, in its thousands of volumes of correspondence with diplomatic and consular officers abroad and with representatives of other governments in the United States, possesses the fundamental documents for the history of American diplomacy and foreign policy; and only a small pro-

portion of them have been printed. Other activities of the nation and its people are reflected in long series of volumes of domestic and miscellaneous letters and in the early territorial papers, now fortunately being edited and published. In recent years, moreover, the department has concerned itself with scientific activities other than those of interest primarily to students of history and political science. It administers the contributions of the United States to international scientific agencies, makes arrangements for international scientific congresses held in the United States and provides for American representation in such congresses held elsewhere; and doubtless these activities are reflected in its archives. The reports from diplomatic and consular officers also contain considerable information about scientific research in foreign countries and other matters of interest to scientists.

The voluminous records of the Treasury Department are obviously of interest primarily to students of economics and economic history—more specifically of public finance and taxation; but its Bureau of Public Health Service engages in research on problems of disease and sanitation, administers hospitals and narcotic farms, regulates the manufacture and sale of viruses, toxins and serums, and enforces quarantine laws and regulations. The correspondence files of this bureau, which go back to 1872, and its other records should be of interest to students of medical history and other scientists. An extensive collection of formulae for medicines and remedies with alcoholic content, accumulated by the alcohol tax unit of the Bureau of Internal Revenue, is said to supplement the data in the United States Pharmacopoeia and similar publications and to be of considerable use to scientists and to officials in other bureaus and departments of the government.

The archives of the War Department have of course inestimable value for the student of military history, and much of the material, including such notable files as the records of General Headquarters in the world war, has not been generally available to historians. A number of the bureaus and services of the department, moreover, such as those concerned with chemical warfare and ordnance, have accumulated data for and records of research and experimentation; and others, such as the Surgeon General's Office, the Corps of Engineers, the Inland Waterways Corporation and the Bureau of Insular Affairs, have extensive records concerning non-military affairs of great interest to students of the natural and the social sciences and of history. The archives of the office of chief of engineers include, for example, over fifty thousand maps and charts, and many field-books, surveyors' notes and journals of expeditions. The files of two temporary agencies of the world war period, the Council of National Defense and the Committee on Public Information, both on deposit in the custody of the War Department, will have to be exploited before a definitive history of American participation in the war can be written.

The Navy Department, also, has, in addition to voluminous records of the war and peacetime activities of the navy and the marine corps, extensive records and data concerning experiments and investigations in the performance of guns, engines, ships and airplanes; drawings of naval vessels and engines; ship log-books of exploratory expeditions; and other non-military material accumulated by the bureaus of navigation, ordnance, engineering, aeronautics, medicine and surgery, and construction and repair, and by the Board of Medical Examiners and the Naval Observatory.

Of exceptional value for students of sociology and of public health and medicine are the archives of the Veterans' Administration. Here are to be found fairly continuous records extending over a considerable period of years of the circumstances of over five million men and their families. They are concerned with such matters as health, medical care, education, rehabilitation and employment; and they provide the raw data for a survey of the life of a large segment of the American people in prosperity and in depression. They include detailed medical histories of hundreds of thousands of cases.

The records of the Post Office Department, extending back to the beginning of the Federal Government, reflect not merely the activities of the department but also the improvement of roads, the development of stage-coach lines and other means of travel and transportation and the movement of the population as indicated by the establishment of post offices.

A number of the branches of the Interior Department, such as the Bureau of Mines and the Geological Survey, are primarily institutes for research in the natural sciences with special application to the resources of the country, and their archives are what one would expect to find in such institutes. The Office of Education is similarly a research agency in its field, with much material in its archives for the history of education. The extensive records of the Bureau of Indian Affairs are invaluable not only as sources of information on the history of Indian relations but also as materials for the study of ethnology and anthropology; and the General Land Office possesses tons of records of the surveying and disposition of the public domain—fundamental material for the study of the westward movement. An aspect of that movement, involving the application of scientific knowledge, is also illustrated in the records of the Bureau of Reclamation. The National Park Service

has in recent years accumulated much material concerning the scientific and historical aspects of the many parks, battlefield sites and national monuments under its supervision, and its administrative records should be of interest to the sociologist for the light they throw on the recreations of the people.

The multitudinous activities of the Department of Agriculture are also concerned largely with scientific research, and the archives of the bureaus of dairy, animal and plant industry, chemistry and soils, entomology, agricultural engineering and biological survey, the forest and soil conservation services, the Food and Drug Administration and the Weather Bureau include material of interest to natural scientists. The Weather Bureau files contain geological as well as meteorological data and also logbooks of voyages of early American vessels. Students of the social sciences will also find material of value in the records of these bureaus and services as well as in those of the bureaus of agricultural and home economics and of emergency wartime agencies such as the Committee on Cotton Distribution and the wool division of the War Industries Board.

The Department of Commerce, although a comparatively recent creation, includes a number of bureaus that have had a long existence and have accumulated vast quantities of records. Of outstanding importance to students of history, economics and sociology are the original schedules of federal censuses in the custody of the Bureau of the Census. Although some schedules have been destroyed and others dispersed, the collection is sufficiently complete to form, with the records of the Land Office previously mentioned, a veritable Domesday Book of the American people. Beginning in 1850 the population schedules contain the name of each individual with his age and country or state of birth; and, as the data are grouped by families, it is possible to derive from them not only biographical and genealogical facts but also reliable statistical information concerning family migrations and the origins of the population of any given region. The simple analyses and computations of the earlier censuses by no means exhausted the possibilities offered by the data in the schedules, and the time will come when students of economic, social, regional and local history will demand that these data be interpreted statistically as fully as have been the corresponding data of the more recent censuses. The work of the Bureau of Standards, including tests and investigations in connection with the establishment of working standards used in science, engineering, industry and commerce, and a wide variety of chemical, physical and metallurgical studies of raw materials and manufactured articles, is well known to natural scientists. Many of its data are confidential and the results of its studies are sometimes available only to the government or to the industries concerned, but it would seem that they could be opened to scientists and students of business in the course of time and would be of value to them. The importance for scientists and economists of the records of other branches of the department such as the bureaus of foreign and domestic commerce, air commerce, fisheries, navigation and steamboat inspection, the Coast and Geodetic Survey (the oldest research agency of the government), the Patent Office and the United States Shipping Board are obvious as soon as the agencies are named.

The Smithsonian Institution, including the Bureau of American Ethnology, the Astrophysical Observatory, the National Zoological Park and the National Museum, is concerned primarily with research in the natural sciences. Though supported in part by private endowments, it is a recognized agency of the government and its records are a part of the national archives.

Economists and economic historians will ultimately make extensive use of the records of such established agencies of the government as the Labor Department, the Interstate Commerce Commission, the Federal Trade Commission and the Tariff Commission, and of such innovations, whether permanent or temporary, as the National Recovery Administration, the various labor relations boards, the Federal Coordinator of Transportation, the Resettlement Administration, the National Resources Committee, the Tennessee Valley Authority, the Public Works Administration, the Works Progress Administration and the Federal Emergency Relief Administration. The voluminous records of the hearings held by the NRA and the AAA, constituting a cross-sectional survey of conditions and of opinions at the nadir of the depression, are now available in a number of institutions in the form of micro-film reproductions, as a result of the activity of the Joint Committee on Materials for Research organized some years ago by the American Council of Learned Societies and the Social Science Research Council. With so many temporary agencies of government set up outside the regular departments, special care is needed to insure the preservation of their archives.

In addition to the archives of the executive departments and independent agencies, there are those of the courts and of Congress. The records of cases in the Supreme Court, the Court of Claims and the lower federal courts, including petitions, evidence, briefs and decisions on all sorts of subjects, are valuable not only to legal historians but also to students of social, economic and even political history, and occasionally contain material of interest to the natural scientist.

The printed reports, voluminous though they are, by no means include all the material of interest to scholars, and the printed briefs are usually to be found only in the files of the courts. The records of Congress, known as Senate Files and House Files, also are very miscellaneous in subject-matter and have been printed in considerable part; but they include much valuable unpublished material, such as petitions and memorials, copies of documents the originals of which have disappeared from departmental files and records of committee hearings and transactions.

Enough has been said to make it clear that the body of records known as the national archives is of vital importance for the advancement of science on many fronts. It remains to consider briefly, in conclusion, the contributions that may be made to the advancement of science by the new institution known as The National Archives. Obviously these will be primarily along the line of promoting the preservation of the archives themselves, making their content and value known, and making them readily available to scientists wherever located. These results should be achieved not only for the material transferred to the custody of the archivist but also for that retained by the departments, in view of the authority given to the archivist to inspect the records of government agencies wherever they are and to make recommendations to Congress with reference to proposals for the destruction of supposedly useless papers. It may be confidently expected, moreover, that The National Archives will make many contributions to what may for convenience be called archival science. Certainly it will engage in research on problems involved in the repair, preservation, reproduction and utilization of documents and of film records; and its discoveries should tend to promote improvement in the treatment of archives and historical manuscripts in depositories throughout the country.

SCIENTIFIC EVENTS

A PROTEST AGAINST THE EXPLOITATION OF THE ROCKY MOUNTAIN NATIONAL PARK

A PROTEST has been issued by the following organizations concerned with conservation against the exploitation of the Rocky Mountain National Park: The National Association of Audubon Societies, Izaak Walton League of America, the General Federation of Women's Clubs, the American Planning and Civic Association, the American Forestry Association, the Garden Club of America, the American Wildlife Institute, the National Parks Association, the Society of American Foresters, the American Association of Museums, the National Conference on State Parks, the Massachusetts Forest and Park Association and the Wilderness Society.

The protest reads:

Believing that the National Parks, set aside for the use, enjoyment and education of the people of the United States, should be protected from commercial exploitation, we earnestly protest against congressional authorization of a project to dig a thirteen-mile tunnel through Rocky Mountain National Park, to transform Grand Lake into a reservoir, and to build some eight thousand feet of covered ditch within the park in order to divert water from the Colorado River watershed into the Platte River watershed.

We submit that the Grand Lake-Big Thompson Intermountain Diversion project, included by the Senate on March 2 as a rider to the Interior Department Appropriation Bill, has not been adequately investigated, has not been approved by the Budget Bureau, and has not been considered by the appropriate committees in either house of Congress.

Moreover, the Congress by amendment to the Federal Power Act has enunciated the policy that National Parks should be exempt from power projects. The scheme to divert the waters of beautiful Grand Lake and to tunnel through the heart of the Rocky Mountain National Park involves the development of power and the construction of unsightly power lines near the eastern and southern boundaries and across a scenic area which has long been contemplated for addition to the park.

In the building of the tunnel the disposition of debris will deface the landscape and leave a scar on the wilderness character of the park and its environs. We have no faith in promises to maintain the level of Grand Lake if water becomes needed for power or growing crops in dry years.

We submit that this project violates the most sacred principle of National Parks, namely, freedom from commercial or economic exploitation and that if approved by Congress it will establish a precedent for the commercial invasion of other parks. We urge that the American people rally to the defense of their National Park system and demand of Congress that this project be stopped.

CHEMICAL ABSTRACTS

IN a report of progress on the work of *Chemical Abstracts*, the editor, Professor E. J. Crane, of the Ohio State University, states that the total number of abstracts of papers describing original investigation in science and industry, together with abstracts of patents, aggregated 61,834 during the past year, an increase of 1,639 over the previous twelve months.

Biological chemistry was far in advance of all other fields, being credited with 10,486 abstracts. General and physical chemistry was second with 4,044, and organic chemistry third with 3,299. Articles number-

ing 2,781 were devoted to subatomic phenomena and radiochemistry. Abstracts in twenty-four classifications dealt directly with industrial research. The chief fields included: Metallurgy and metallography, 2,338 abstracts; soils, fertilizers and agricultural poisons, 1,993; foods, 1,434; pharmaceutical chemistry, 1,175; fuels, gas, tar and coke, 1,144; petroleum, lubricants, asphalt and wood products, 1,021; water, sewage and sanitation, 924; glass, clay products, refractories and enameled metals, 872; dyes and textile chemistry, 855; mineralogical and geological chemistry, 828; cellulose and paper, 775; electrochemistry, 750; apparatus, plant equipment and unit operations, 736.

Chemical industry and miscellaneous industrial products, 618; paints, varnishes and natural resins, 617; fats, fatty oils, waxes and soaps, 607; acids, alkalies, salts and other heavy chemicals, 543; cement and other building materials, 529; fermentation industries, 478; rubber and allied substances, 449; sugar, starch and gums, 428; leather and glue, 367; photography, 289; explosives and explosions, 181.

Chemical Abstracts is a non-commercial agency which aims to bring to science and industry knowledge of developments in chemistry wherever arising. It reflects the greatest activity in the twenty-eight years of its history.

The report states that more than 2,000 scientific journals published in many languages are examined systematically by 500 chemists who work under the direction of Professor Crane and a staff of forty-five assistant editors. Chemical patents are also abstracted, and these, too, provide evidence of industrial readiness.

THE JOHNS HOPKINS UNIVERSITY RESEARCH CONFERENCES IN BIOLOGY, CHEMISTRY AND PHYSICS

THE departments of biology, chemistry and physics of the Johns Hopkins University will hold a research conference this summer at Gibson Island near Baltimore. The conference will be under the general direction of Professor Neil E. Gordon and will run five weeks from June 22 to July 24. The plan is flexible, varying from day to day according to the nature of the topic under discussion and the wishes of those participating. The day begins with a more or less formal lecture outlining some field of research and directing attention to its unsolved problems. This is followed by a discussion in which each one present takes part, making what contribution he can to the solution of the problems presented. The ideal is to have a group large enough so that all points of view may be represented, yet small enough that all who wish may take active part. The plan is for recognized leaders in each field of research to give the lectures and start the discussions. Its success depends on having a number in the group who are capable of contributing ideas. The remainder of the day is left to sports or conversations. These conferences are intended to combine mental stimulation, pleasant personal contacts and healthful recreation. The Gibson Island Club generously shares its facilities with scientists for this period. The club has an excellent golf course, fine tennis courts and splendid swimming and beaches. There is excellent fishing in the surrounding Chesapeake. Attendants on the conferences may secure rooms in the club or adjacent cottages or may come from Baltimore for the day. Meals for all are served at the club.

The program given below is to be regarded as tentative, to be filled in or modified as may seem best.

A. *Nuclear Physics*—John A. Fleming, *chairman*, June 22–27. Speakers: Drs. E. Fermi and F. Rasetti, M. A. Tuve, G. Breit, J. W. Beams.

B. *Photochemistry*—W. A. Noyes, Jr., *chairman*, June 29 to July 4. Speakers: Drs. E. Teller and O. R. Wulf, R. S. Mulliken, L. A. Turner and P. A. Leighton.

C. *Tissue Respiration*—Charles Glen King, *chairman*, July 6–11. Speakers: Drs. K. A. C. Elliott, C. A. Elvehjem, E. S. G. Barron and F. Bernheim.

D. *Chemistry of Olefins from Petroleum*—Thomas Midgley, Jr., *chairman*, July 13–18. Speakers: Drs. F. C. Whitmore, B. T. Brooks and G. Egloff.

E. *Synthetic Resins*—Leo H. Baekeland, *chairman*, July 20–25. Speakers: Drs. E. E. Reid, H. L. Bender, H. J. Barrett, H. A. Bruson, J. R. M. Klotz, H. T. Neher, G. O. Curme, Jr., and S. D. Douglas, I. Allen, Jr., T. F. Bradley, A. M. Howald, L. V. Redman.

NEIL E. GORDON

IN HONOR OF GEORGE ELLERY HALE

To honor Dr. George Ellery Hale, a symposium was held at the Harvard Observatory on the afternoon of Tuesday, April 7. Brief talks by eight scientists presented some of the important phases of Dr. Hale's work and gave a picture of his extraordinary achievements and his great influence on American science, especially on astronomy. His contributions to astronomy began in his college days, when he first experimented in solar photography. From then on he continued his scientific work, through his student days at the Massachusetts Institute of Technology (when he was also a volunteer observer at the Harvard Observatory). Later, while he built the Kenwood Observatory and then organized the Yerkes Observatory in connection with the University of Chicago, he carried on not only the laborious administrative work but a great deal of astronomical research as well.

Science in many fields is indebted to Dr. Hale for

his activity in the National Academy of Sciences and especially for his part in the creation of the National Research Council. His conviction that it was important to publish results promptly led to the organization of the *Proceedings* of the National Academy, which have continuously brought out short papers on current researches in many sciences by members of the National Academy and their colleagues. Dr. Hale was instrumental also in the founding of the *Astrophysical Journal*, of which he has been an editor from its beginning.

Dr. Hale's founding of the Mount Wilson Observatory, his building of successively greater telescopes for long-distance and large-scale observations, from the 40-inch refractor to the new 200-inch reflector, and his inspiration and efforts that resulted in the creation and growth of the California Institute of Technology are well known to all scientists. That he has achieved so much administratively and at the same time added such a wealth of knowledge in special fields of astronomy, particularly in solar physics and instrumental design, stands as the mark of a great man and a great scientist.

The program of the Harvard symposium, organized by Dr. Harlow Shapley, is as follows:

Biographical Notes. Dean H. M. Goodwin, Massachusetts Institute of Technology.

Dr. Hale as a Student Assistant at Harvard. Professor W. P. Gerrish, Harvard Observatory.

Kenwood and Yerkes Observatories and the Astrophysical Journal. Dr. G. P. Kuiper, Harvard Observatory.

Mount Wilson Observatory. Dr. Robert B. King, Massachusetts Institute of Technology.

California Institute of Technology. Dr. E. B. Wilson, Jr., Society of Fellows, Harvard University.

National Academy of Sciences and the National Research Council. Dr. Arthur L. Day, Geophysical Laboratory, Carnegie Institution of Washington.

Dr. Hale's Contributions to Solar Physics. Dr. Theodore Dunham, Princeton University and Mount Wilson Observatory.

The Manufacture of the 200-inch reflector. Dr. George V. McCauley, Corning Glass Works.

J. MOHR

HARVARD COLLEGE OBSERVATORY

RECENT DEATHS

PROFESSOR EDWARD H. PERKINS, head of the department of geology at Colby College and since 1929 assistant state geologist for Maine, died on April 13 at the age of fifty years.

DR. CHARLES V. GREEN, research associate at the Roscoe B. Jackson Memorial Laboratory at Bar Harbor, Me., was drowned on April 18, when the boat from which he was fishing overturned. He was thirty-four years old.

DR. HARLOW BROOKS, professor of clinical medicine at New York University, past president of the College of Physicians, died on April 13 at the age of sixty-five years.

DR. WILLIAM BRADLEY COLEY, formerly professor of clinical cancer research at Cornell University Medical College, surgeon-in-chief emeritus of the Hospital for the Ruptured and Crippled, New York City, with which he had been connected for forty-five years, died on April 16, at the age of seventy-four years.

WILLIAM LOUIS ABBOTT, formerly director of the Philadelphia Zoological Gardens and honorary associate zoologist of the Smithsonian Institution, died on April 2 at the age of seventy-six years.

Nature reports the death of James Whitehead, fellow of the Imperial College of Science and Technology, who was a leading authority on patent law, especially in its applications to technology, on April 3, aged fifty-eight years; of Dr. W. A. Parr, president of the British Astronomical Association in 1932–34, on April 2, and of Professor J. Stoklasa, director of the State Institute of Research in Plant Products, Prague, on April 4, aged seventy-six years.

SCIENTIFIC NOTES AND NEWS

THE honorary degree of doctor of laws of the University of Wisconsin will be conferred in June on Dr. Isaiah Bowman, president of the Johns Hopkins University.

Nature states that on the occasion of the centenary celebration of the University of London, degrees will be conferred *honoris causa* on thirteen British and six foreign distinguished men, including Sir William Bragg, S. A. Courtauld, Sir Joseph Larmor, Dr. J. W. Mackail, Sir George Newman, Sir Charles Peers and H. G. Wells; and Professor Albert Einstein, Professor Johan Hjort and Professor Max Planck.

DR. M. J. BLISH, chemist of the Nebraska Agricultural Experiment Station, has been awarded the Thomas Burr Osborne Medal for his work in cereal chemistry. Presentation of the medal will occur at the annual convention of the American Association of Cereal Chemists, at Dallas, Texas, on June 2.

AT the recent Kansas City meeting of the American Chemical Society, the Langmuir prize of $1,000 was awarded to Dr. John Gamble Kirkwood, assistant professor of physical chemistry at Cornell University, for his work in molecular chemistry.

THE Grande Médaille à l'effigie d'Isidore Geoffroy St. Hilaire has been awarded by the Société Nationale d'Acclimatation de France to Sir Arthur Hill, director of the Royal Botanic Gardens, Kew, and to Dr. V. Van Straelen, director of the Royal Museum of Natural History, Brussels.

M. J. DE LAPPARANT, professor of petrography at the University of Strasbourg, has been elected a correspondent of the Paris Academy of Sciences in the section of mineralogy.

THE German Society of the History of Medicine, Science and Technology has elected Dr. Arthur Meiner, J. A. Barth, C. Kabitzsch, H. Meusser and L. Voss to honorary membership in recognition of their services to the history of science.

HENRY BALFOUR, curator of the Pitt-Rivers Museum and fellow of Exeter College, Oxford, has been made a member of the Athenaeum Club, London, under the provision which empowers the annual election by the committee of "a certain number of persons of distinguished eminence in science, literature, the arts or for public service."

AT the third annual meeting of the American Institute of Nutrition held in Washington, D. C., on March 25, the following officers were elected: *President,* Eugene F. DuBois; *Vice-president,* Mary Swartz Rose; *Treasurer,* George R. Cowgill; *Secretaries,* C. A. Elvehjem, R. M. Bethke and L. A. Maynard; *Editorial Board,* E. M. Nelson, F. C. Koch, Grace MacLeod and L. H. Newburgh.

AT the twenty-ninth annual meeting of the American Association for Cancer Research held in Boston on April 8, the officers elected were: Dr. William H. Woglom, *president;* Dr. James Ewing, *vice-president;* Millard C. Marsh, *secretary-treasurer.* Dr. E. T. Bell was elected a member of the council.

Nature reports that at the annual meeting of the Ray Society, London, the following officers were re-elected: *President,* Sir Sidney Harmer; *Treasurer,* Sir David Prain; *Secretary,* Dr. W. T. Calman. Dr. Robert Gurney was elected a vice-president, and Dr. G. P. Bidder, Dr. Malcolm Smith and Captain Cyril Diver were elected new members of the council.

AT the recent annual meeting of the Royal Meteorological Society, London, the following officers were elected: *President,* Dr. F. J. W. Whipple; *Vice-presidents,* Charles J. P. Cave, Lieut.-Col. Ernest Gold, Capt. W. N. McClean, W. M. Witchell; *Treasurer,* R. A. Watson Watt; *Secretaries,* Dr. J. Glasspoole, E. L. Hawke, M. McCullum Fairgrieve; *Foreign Secretary,* Capt. C. J. P. Cave; *New Members of Council,* Dr. C. E. P. Brooks, A. H. R. Goldie, W. G. Kendrew, J. F. Shipley.

PROFESSOR JOHN A. HUNTER, since 1906 head of the department of mechanical engineering at the University of Colorado, and Dr. Severance Burrage, associate professor of bacteriology in the School of Medicine, will retire at the close of the academic year.

DR. HAROLD E. HIMWICH, who joined the faculty of the Albany Medical College, with the rank of associate professor, in October, 1935, has been appointed professor of physiology and pharmacology.

PROFESSOR J. G. SEMPLE, professor of mathematics in the Queen's University, Belfast, has been appointed professor of mathematics at King's College, University of London. Dr. C. D. Ellis, lecturer in natural science at Trinity College and lecturer in the department of physics of the University of Cambridge, has been appointed to the Wheatstone chair of physics, also tenable at King's College. Professor H. H. Woollard has been appointed to the university chair of anatomy tenable at University College. Since 1929 he has been professor of anatomy at St. Bartholomew's Hospital Medical College.

DR. RALPH W. PHILLIPS, instructor in animal husbandry at Massachusetts State College, has left Amherst to become associate animal husbandman with the U. S. Department of Agriculture. He will be stationed at the National Research Center, Beltsville, Md.

DR. A. E. ALEXANDER, mineralogist at the Buffalo Museum of Science, has been appointed petrographer in the ceramic laboratory of the Electric Auto-Lite Company, of Toledo, Ohio.

SIR PATRICK LAIDLAW has been appointed by the British Medical Research Council to be deputy director of the National Institute for Medical Research, and head of the department of pathology and bacteriology, in succession to the late Captain S. R. Douglas.

MEMBERS of the Research Procedure Committee of the Engineering Foundation for 1936 are: F. F. Colcord, metallurgist, U. S. Smelting, Refining and Mining Company; F. M. Farmer, vice-president and chief engineer, Electrical Testing Laboratories; Thaddeus Merriman, consulting engineer, New York City, and W. H. Fulweiler, consulting chemist, Wallingford, Pa.

PERRY BURGESS, president of the Leonard Wood Memorial Foundation, recently spent some time in Puerto Rico and the Virgin Islands. Mr. Burgess lectured at the School of Tropical Medicine, where he gave an account of his activities as head of the organization.

THE Edgar Fahs Smith Memorial Lecture at the University of Pennsylvania will be given on May 22 by Dr. Julius O. Stieglitz, professor emeritus of chemistry at the University of Chicago, on "Chemistry and Progress in Medicine."

DR. SAMUEL T. ORTON, professor of neurology and neuropathology at the College of Physicians and Surgeons of Columbia University, gave on April 10, 17 and 24 at the New York Academy of Medicine the fourth series of the Thomas William Salmon Memorial Lectures. The general subject of the lectures was "Developmental Disorders of the Language Faculty and their Psychiatric Import."

DR. ROBERT A. MILLIKAN, of the California Institute of Technology, delivered the Page-Barbour Lectures at the University of Virginia on April 20, 21 and 22. His subject was recent work on the cosmic rays.

DR. MAX JAKOB, formerly in charge of the heat laboratories of the Physikalische-Technische Reichsanstalt, gave six free public lectures at Harvard University and the Massachusetts Institute of Technology during the week of April 7 on "Heat Transfer and the Properties of Steam."

DR. LEON ASHER, director of the Physiological Institute of the University of Berne, Switzerland, lectured before the Biological Society of the University of Maryland on April 15. His subject was "The Nervous System and the Internal Secretions."

THE Society for Research on Meteorites, which is associated with the American Association for the Advancement of Science, will hold its fourth annual meeting at the University of California at Los Angeles on June 23 and June 24, under the presidency of Dr. Frederick C. Leonard. There will be two sessions a day for the reading of technical papers. At six o'clock on Tuesday evening there will be a dinner for members and their guests, followed by an excursion to the neighboring Griffith Observatory and Planetarium, at which a lecture demonstration will be given at eight o'clock. The scientific sessions will be open to the public.

THE annual Conference for Medical Officers in Industry Oversea will be held on July 16, at the London School of Hygiene and Tropical Medicine, in order that medical officers in industry on leave from the tropics may be able to meet their colleagues for discussion. The main subjects will be the control of malaria and epidemic diseases in the tropics and hygiene.

THE conversaziones of the Royal Society will be held this year on May 28 and June 29 in the rooms of the society in Burlington House, London. A third soirée will be held on July 28 in connection with the Second International Congress for Microbiology.

THE Committee on Scientific Research of the American Medical Association invites applications for grants of money to aid in research on problems bearing more or less directly on clinical medicine. Preference is given to requests for moderate amounts to meet specific needs. For application forms and further information, please address the Committee at 535 North Dearborn Street, Chicago, Illinois.

Industrial and Engineering Chemistry states that the American Institute of Mining and Metallurgical Engineers has authorized the appointment of a committee to draw up rules of procedure under which awards can be made to petroleum engineers for outstanding contributions to the art of finding and producing oil and gas. The awards will be sponsored by the Petroleum Division of the institute and are in memory of Anthony F. Lucas, a pioneer in the oil industry. The first medal is to be presented in February, 1937.

HOWARD UNIVERSITY SCHOOL OF MEDICINE, Washington, has received a grant of $100,000 from the Rockefeller Foundation, to be used over a period of five years toward the development of the departments of medicine and surgery.

THE Rockefeller Foundation has made an appropriation of $10,000 to Columbia University, with the provision that $8,000 is to be used for research on poliomyelitis, and $2,000 for research on speech disturbances and other neurological problems.

THE following additional awards have been made from the Elizabeth Thompson Science Fund: to Charles J. Fish, Rhode Island State College, $100.79 for apparatus to be used in an investigation of the annual cycle of the endemic species of Narragansett Bay; to Arthur Jacot, Appalachian Forest Experimental Station, $60 for traveling expenses to and from southeast Georgia for the purpose of duplicating Thomas Say's collection of mites, said collection to be deposited in the Museum of Comparative Zoology; to Kurt Stern, Department of Physiological Chemistry, Yale University, $200 for purchase of equipment to be used in an investigation of the chemical constituents of the enzyme catalase. The trustees of the fund meet annually in April. Applications for grants should be sent well in advance of the meeting to the secretary, Dr. Jeffries Wyman, Jr., Biological Laboratories, Harvard University, Cambridge, Mass.

THE Toledo, Ohio, Zoological Society has under construction adjacent to the Zoological Park buildings for a Museum of Natural and Social Science, to be erected at a cost of $900,000; an aquarium, at the cost of $350,000, and a bird house, at the cost of $250,000. A botanical garden with a large greenhouse has also been planned. The group includes ten major buildings, and is three miles from the heart of the Toledo business district. The new construction is expected to be complete about July 1.

IT is proposed to erect a museum building at the University of Texas. Plans for the first unit have been approved by the Board of Regents, which serves as the executive committee for the museum. The building will cost $750,000, of which $300,000 has been appropriated by Congress and $225,000 by the Texas legislature. The balance will be raised by private donations and by the sale of centennial coins.

CONSTRUCTION of the Rothschild-Hadassah-University Hospital on Mount Scopus, overlooking Jerusalem, according to *The New York Sun,* probably will begin late this summer. Dr. Jacob J. Golub, director of the Hospital for Joint Diseases, New York City, is consultant to the building committee of the hospital. It will be the first medical center in Palestine and will cost about $750,000. On a twenty-five-acre plot will be three units of buildings, each three stories high; a 260-bed hospital, a graduate medical school, with complete laboratories and a nurses' training school and residence. The school has been named the Nathan Ratnoff Medical School, in honor of the chairman of the American Jewish Physicians' Committee, which has for a long time sought to add a medical department to the Hebrew University in Palestine. The nurses' school will be the Henrietta Szold School, named in tribute to the founder of Hadassah, the women's Zionist organization which is cooperating with the American Jewish Physicians' Committee in building the medical center. Erich Mendelsohn, architect, who is a refugee from Nazi Germany, designed the buildings.

THE establishment of a Tropical Medical Research Committee is announced by the *British Medical Journal.* The decision to appoint this new body has been taken by the Medical Research Council in consultation with the Colonial Office. The new committee will advise and assist in the direction of such investigations as the council may be able to promote, whether at home or abroad, into problems of health and disease in tropical climates, and make suggestions generally as to research in this field. The committee will be a purely scientific body. It will include representatives of the Colonial Office and of the Liverpool and London Schools of Tropical Medicine, with other members appointed as individual experts in tropical medicine or in different branches of medical science. The following will serve in the first instance: Professor J. C. G. Ledingham, (chairman), Professor A. J. Clark, Dr. N. Hamilton Fairley, Professor W. W. Jameson, Dr. Edward Mellanby, Dr. Muriel Robertson, Major-General Sir Leonard Rogers, Dr. H. Harold Scott, Sir Thomas Stanton, Dr. C. M. Wenyon, Professor Warrington Yorke and Dr. A. Landsborough Thomson, secretary. The *Journal* writes: "Research in tropical medicine has always been of concern to the Medical Research Council, whose constitutional position under a Committee of the Privy Council leaves its work unrestricted by territorial limitations. The responsibility was explicitly recognized when the Secretary of State for the Colonies was added to this committee of the Privy Council on its reconstitution in 1926. The council has, however, not hitherto been able to assist investigations in the tropics except on isolated occasions, although it has regularly made grants for work at home in relation to tropical problems. The step now announced indicates an intention to take a more active part in work in this field."

THE Carnegie United Kingdom Trustees have allocated £5,000 for grants to museums in Great Britain for reorganization and development during the period 1936–1940. Grants will normally not exceed £500, and may be used only for carrying out definite schemes of bettering exhibition, labeling, etc. Applications for these grants are handled through the Museums Association. The trustees have also set aside funds for establishing two or three experimental schemes for extending museum services to rural areas, and for travel grants to museum curators. Grants for these experiments will be about £1,000 each.

DISCUSSION

ANTARCTIC FOSSIL PLANTS

RECENTLY the Geological Museum of Harvard University obtained the specimens of rocks and fossils collected by the Admiral R. E. Byrd Expedition to Little America. The fossil plants and coal have been transmitted to the writer for study and description.

The material was collected on Mt. Weaver, 10,000 feet above sea-level, south latitude 86° 58′ and west longitude 152° 30′. This occurrence is located more than 20° further south than the only described extensive Antarctic collection. The Swedish South Polar Expedition[1] of 1901–03 found a luxuriant flora on Grahamland, Hope Bay, south latitude 63° 15′. Grahamland lies south of South America and north of Antarctica. Mount Weaver, scarcely 3° from the South Pole, lies south of New Zealand. The British Antarctic expeditions[2] of 1910–1914 collected a Triassic florule from south latitude 85°.

[1] T. G. Halle, "Mesozoic Flora of Graham Land," Schwed. South Polar Exped., 1901–03, Bd. 3, lief. 14, 1913.

[2] A. C. Seward, British Antarctic Expedition Natural Hist. Rept. Geol. v. 1, No. 1: 1–49, 1914.

The paleobotanical collection is very meager and is interesting chiefly because of its geographic remoteness. There are recognizable species of *Taeniopteris*, *Sagenopteris* and *Araucarites*. Their age is most probably Jurassic. The presence of large Taeniopteris shows a relation to the contemporaneous Australian flora and indicates a point of difference from the Grahamland Flora, which is regarded to be of Upper Jurassic age. More abundant material might reveal the age of the Mount Weaver florule to be Upper Triassic (Rhaetic). *Sagenopteris* is a member of the Caytoniales. The two forms attributed to this genus may belong to a single species close to *S. plurifolia* (*phillipsi*), but no complete compound leaf has been found. *Sagenopteris* is more abundant in the Jurassic than the Triassic.

Taeniopteris is an artificial genus which includes a diverse lot of similar leaves probably belonging to various cycadophytes. Leaves attributed to *Taeniopteris* first occur in the uppermost Carboniferous and extend to the Lower Cretaceous. However, the fine-nerved, broad mid-ribbed forms are characteristically Mesozoic.

The general aspect of the florule recalls that of a typical "Oolitic" flora of England, Australia or Japan.

The occurrence of a well-developed vegetation during Mesozoic times at a polar region deserves an explanation. Either the land-masses were located differently during remote antiquity or there was a marked difference in climate. The Wegenerian hypothesis of continental drift has found no support among American geologists, but it would offer an apparent explanation. Nevertheless, similar conditions of climate can be explained by other hypotheses which involve fewer difficulties.

According to the simplest statement of Wegener's theory, during the late Paleozoic the various "continents" began splitting apart and drifting westwardly. During the early Mesozoic, Australia, Africa and Antarctica severed their connections, but even Antarctica remained north of the Antarctic circle. Consequently a hospitable temperate climate would have existed. Few students of earth-processes deny all continental shifting, but few accept Wegenerism fully. More probably irregularities in earth motion, of astronomic cause, altered climate by "shifting poles."

Perhaps of more significance than the occurrence of fossil plants is the presence of good, relatively thick, coals on Mount Weaver. The coal is a dull, black, anthracitic, bituminous material. Microscopic preparations are being made by collodion peels, maceration and grinding. Coniferous wood of araucarian type is present in the "bright bands" of the coal.

The fossil plants and coal will be fully described and figured in the near future. The collection will be exhibited in the galleries of the Geological Museum of Harvard University.

I am indebted to Professor Kirtley F. Mather for the opportunity to study these specimens.

WM. C. DARRAH

BOTANICAL MUSEUM
HARVARD UNIVERSITY

LAKE VEGETATION AS A POSSIBLE SOURCE OF FORAGE

COMMENTING upon the article by Dr. Ross Aiken Gortner, of the University of Minnesota, published under the above title in SCIENCE, No. 2084, of December 7, 1934, I should like to point out that in Yugoslavia it is a general custom among the peasants to use water plants as forage in districts subject to drought in summer and where there is an abundance of vegetation in the waters. For example, one district where this use is made of water plants is that of the Gacka river near Otočac in the Lika region, which is part of Croatia. The Gacka is a ponor-river about 20 kilometers in length and contains a great many springs rising from the floor of the river bed. It has an even temperature all the year round, which does not fall below 9° C. in the winter nor rise above 20° C. in the summer. The course of the river is not very steep, and the water flows gently on in an even deep bed. For this reason it produces luxuriant vegetation throughout the year. The most common plants found in it are miriophyllum, potamogeton, ranunculus and callitriche, while nasturtium grows near the springs and sphagnum in the lower course of the river, which forms a lake at certain times of the year. The country through which the river flows is rocky, with only a shallow layer of vegetable soil, which often dries up completely during the hot summer months, and only produces sufficient fodder for the cattle in the spring and autumn. In that district the peasants may be seen using the river vegetation as fodder throughout the whole year, but particularly during the hot summer months and in the winter. Every day they cut the water plants just above the roots with a kind of long-handled scythe or simply drag them up with long rakes. Then they collect the plants on the surface of the water and load them onto a primitive kind of canoe hollowed out of the trunk of a tree. The plants are only dried for a short time, long enough to drain off the water, and are then used as fodder while still *fresh*, that is to say, in the green state. The cattle like this fodder and digest it as easily as the ordinary green fodder. From this, it is obvious,

therefore, that where similar conditions exist, that is to say, where there is an abundance of water plants in clear cool waters, the former can be used for fodder with great advantage.

I have found from experience that the vegetation growing in marshy warm waters can not be used to feed cattle on account of the musty odor, which they dislike. For example, plants growing in ponds used for carp breeding are not suitable for fodder. Cows, in particular, show a marked aversion to musty-smelling fodder and are reluctant even to eat the grass round the edges of the ponds. If they are forced to eat this kind of fodder by being given none other, the result is that they give less milk.

VILIM MRŠIĆ

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EGGS BY PHEASANTS AND QUAIL INDUCED BY NIGHT-LIGHTING

IN SCIENCE for March 13, 1936, appeared a short note by Clark, Leonard and Bump[1] describing the results of some experiments on "Light and Reproduction in Game Birds." The birds used were pheasants, quail and grouse. The method followed evidently was one adapted from the earlier work of Bissonnette[2] on starlings and ferrets.

Beginning on December 16, 1935, we have carried out similar experiments independently on pheasants and quail, using Bissonnette's improved methods of illumination.[3] One cock and four hens of the hybrid ring-necked variety of pheasant and a single pair of quail were used as experimental animals. The rest of the colonies of these types of birds were used as controls. The birds were kept in outside cages subject to winter conditions.

On January 15, at thirty days of experimental lighting, the pheasants began to lay and before the 28th they were laying at the rate of about three and a half eggs each day of twenty-four hours in spite of very severe weather. Before March 16 well over 120 eggs were laid by the four hens. Three of them are still laying well at date of writing.

Of the first 37 eggs laid and incubated in an improvised electric incubator, 32, or about 86.5 per cent., were fertile and began development. Owing to trouble with the electric lighting none hatched. Two eggs from a setting placed under a hen and accidentally broken had live chicks in them. The single female quail began to lay on March 22 and is continuing to do so, but none of her eggs have yet been set. None of the controls have yet begun to lay (March 30).

Details of these experiments will be published elsewhere. The authors wish to acknowledge the valuable ecoperation of the State Department of Fish and Game of Connecticut, without which these experiments could not have been carried out.[4]

T. HUME BISSONNETTE

TRINITY COLLEGE

ALBERT G. CSECH

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FARMINGTON, CONN.

[1] L. B. Clarke, S. L. Leonard and G. Bump, SCIENCE, 83: 2150, 268, March 13, 1936.

[2] T. H. Bissonnette, *Quart. Rev. Biol.*, 8: 2, 201–208, 1933.

[3] T. H. Bissonnette, *Jour. Exp. Zool.*, 71: 2, 341–373, 1935; *Jour. Exp. Zool.*, 27: 4, 315–320, 1935; *Anat. Rec.*, 63: 2, 159–168, 1935.

SOME RARE BOOKS ON PROTOZOOLOGY

VERY recently Gustav Foch, of Leipzig, has made a reprint of the monumental work of Ph. Fr. de Siebold "Fauna Japonica," published the first time in 1833–50, and considered since as a classical reference book. Unfortunately, the small original edition and the prohibitive price account for the scarcity of the work. The reprint fills a serious gap in many libraries.

It occurs to me that there are many old and very important reference books on protozoology, as for instance Muller's "Animalcula Infusoria," 1786; Ehrenberg's "Die Infusionsthierchen als Vollkommene Organismen," 1838; Dujardin's "Histoire Naturalle des Zoophythes Infusoires," 1841; Claparéde and Lachmann's "Etudes sur les Infusoires et les Rhizopodes," 1858–61; Stein's "Der Organismus des Infusionthiere," 1854–83; Saville Kent's "A Manual of the Infusoria," 1880–81; etc. All of them are out of print to-day, and when listed in second-hand book catalogues they have a very high price. That accounts for the lack of reference works so important, not only in private laboratories but also in libraries of smaller institutions.

It would be welcome to very many serious students of the protozoa, especially for those not connected with great institutions, if some firm should make a reprint, as economically as possible, of the above-mentioned books. I am sure that, if properly advertised and moderately priced, such reprinted books would have quite a large demand, and make profitable the enterprise.

ENRIQUE BELTRÁN

NATIONAL SCHOOL OF AGRICULTURE
CHAPINGO, MEXICO

SOURCE MATERIAL REQUESTED

WE are starting to work on the history of the botanical succession in the upper Hudson Highlands. To do this thoroughly, we must first reconstruct the original forests as they existed hereabouts at the time

[4] Aided by grants from the National Research Council, Committee for Research in Problems of Sex.

of the first settlements, circa 1683. With these data in hand, we plan to trace down through the years the effect of man's occupancy on the composition of these original forest types.

The second item will not be very difficult. But the first point—an accurate determination of the composition of the old stands—is a different matter. Source material is none too plentiful and we shall be grateful if any of your readers who happen to be informed regarding this subject will communicate directly with the writer.

H. H. TRYON

BLACK ROCK FOREST,
CORNWALL-ON-HUDSON, N. Y.

SOCIETIES AND MEETINGS

THE IOWA ACADEMY OF SCIENCE

THE fiftieth annual meeting of the Iowa Academy of Science was held at the State University of Iowa at Iowa City on April 3 and 4 with two hundred and thirty-nine members and visitors in registered attendance.

The presidential address, "Paul Bunyan turns Scientist," was presented by Dr. R. E. Buchanan, director of the Iowa Agricultural Experiment Station. Other papers of general interest were "Research *vs.* Conservation," by W. W. Aitken, state biologist of Iowa, and "Actuarial Aspects of Old Age Assistance," by L. A. Knowler, of the department of mathematics of the State University of Iowa. The annual address was presented by Dr. W. J. Robbins, professor of botany of the University of Missouri, who also represented the American Association for the Advancement of Science. His subject was "The Relation of Light to Plant Growth and Movement."

At an all-academy dinner commemorating the fiftieth anniversary of the academy the following members were honored: Herbert Osborn, first president of the academy, C. P. Gillette, B. Shimek, Charles Carter, S. W. Stookey, Maurice Ricker, G. L. Houser, R. I. Cratty, W. H. Norton, L. S. Ross, E. D. Ball, J. C. Arthur, H. M. Kelly, C. R. Keyes, Paul Bartsch, H. L. Bruner, T. J. Fitzpatrick, F. E. Leverett, Charles D. Reed and H. W. Norris.

The following officers and section chairmen were elected for the next meeting: *President,* L. P. Sherman, Grinnell College; *Vice-President,* A. C. Trowbridge, State University of Iowa; *Secretary-Treasurer* and *American Association for Advancement of Science Representative,* J. C. Gilman, Iowa State College; *Editor,* Mrs. F. W. Nichols, Ames; *Botany and Bacteriology,* R. A. French, Dubuque University; *Chemistry, general and physical,* A. J. Rider, Drake University; *Chemistry, organic and biological,* G. A. Lillis, St. Ambrose College; *Geology,* J. T. Lonsdale, Iowa State College; *Mathematics,* R. B. McClenon, Grinnell College; *Physics,* William Kadesch, Iowa State Teachers College; *Psychology,* Earl E. Emme, Morningside College; *Zoology,* K. A. Stiles, Coe College.

The academy convened in eight sections for the presentation of one hundred and seventy papers of special interest. The Junior Academy of Science of Iowa met with the academy with an attendance of delegates from sixteen clubs. Dr. G. W. Martin and Dr. P. A. Bond, of the State University of Iowa, presented talks on their program.

JOSEPH C. GILMAN,
Secretary-Treasurer

THE ALABAMA ACADEMY OF SCIENCE

THE thirteenth annual meeting of the Alabama Academy of Science was held at the Alabama Polytechnic Institute, Auburn, on Friday and Saturday, March 20 and 21, with a registration of one hundred and fourteen.

The academy program was divided into four sections, at which 68 papers were presented as follows:

Section I. Biology and Medicine: 27 papers (4 by title and 4 by demonstration).
Chairman, C. M. Farmer, State Teachers College, Troy.
Secretary, Margaret Hess, Judson College, Marion.

Section II. Chemistry, Physics and Mathematics: 17 papers (3 by title).
Chairman, B. F. Clark, Birmingham-Southern College, Birmingham.
Secretary, John Xan, Howard College, Birmingham.

Section III. Geology, Anthropology and Archeology: 12 papers.
Chairman, T. G. Andrews, University of Alabama, Tuscaloosa.
Secretary, David L. DeJarnette, Alabama Museum of Natural History, University of Alabama, Tuscaloosa.

Section IV. Industry and Economics: 12 papers.
Chairman, W. M. Mobley, Alabama By-Products Company, Tarrant.
Secretary, Troy Sizemore, Alabama By-Products Company, Tarrant.

On Friday night at the annual banquet at the Thomas Hotel, the presidential address was given by A. G. Overton under the title "Research, its Value and Influence on Recovery." The toastmaster for this occasion was J. L. Brakefield, Howard College. The address of welcome was given by Dr. Luther Duncan, president of the Alabama Polytechnic Insti-

tute, followed by a response from Dr. R. S. Poor, Birmingham-Southern College. Dr. and Mrs. Duncan tendered the guests a reception in the president's mansion after the banquet.

On Saturday morning a geological and archeological field trip was conducted by Walter B. Jones, state geologist, to sites in the vicinity of the new Chewacla State Park. Later the members visited the Tuskegee Institute.

The Alabama Junior Academy of Science held its fourth annual meeting at the same place at this time. Fifteen high schools from all parts of the state were represented.

The officers elected for 1936–1937 are as follows:

President: Dr. Walter B. Jones, state geologist, University of Alabama, Tuscaloosa (president-elect for the past year).

President-elect: Dr. Roger Allen, Alabama Polytechnic Institute, Auburn.

Vice-Presidents (chairmen of sections):

Dr. C. M. Farmer, State Teachers College, Troy (re-elected), Section I.

Dr. Herman D. Jones, Alabama Polytechnic Institute, Auburn, Section II.

Dr. J. R. Cudworth, director of the State Bureau of Mines Experiment Station, University of Alabama, Tuscaloosa, Section III.

Mr. Fred B. Riggan, Stockham Pipe and Fitting Company, Birmingham, Section IV.

The following officers were reelected:

Secretary: Dr. Septima Smith, University of Alabama (for one year).

Treasurer: Dr. B. F. Clark, Birmingham-Southern College (for two years).

Editor of the Journal: Dr. E. V. Jones, Birmingham-Southern College (for three years).

Councilor to the American Association for the Advancement of Science: P. H. Yancey, Spring Hill College, Mobile.

The next meeting of the academy will be held at the University of Alabama, Tuscaloosa, some time in March, 1937.

SEPTIMA C. SMITH,
Secretary

REPORTS

RESEARCH AT MELLON INSTITUTE DURING 1935–36

MELLON INSTITUTE celebrated this year the twenty-fifth anniversary of the establishment of its industrial fellowship system at the University of Pittsburgh. Since 1911 the institute has had 1,085 industrial fellowships on 268 different subjects of technology, on which 935 scientists and engineers have been employed. Over 500 new or improved processes and products and nearly 2,000 contributions to the literature of pure and applied science have come from these researches. During the past quarter century 363 fellows and 414 fellowship assistants of the institute, having completed their services in the institution, have entered the domains of manufacturing, commerce and education. These trained additions to the forces of industry and teaching constitute the institute's most valuable gift to humanity.

The activities of the institute during the fiscal year, March 1, 1935, to March 1, 1936, are described in the annual report of the director, Dr. E. R. Weidlein, to the board of trustees, just off the press. There was an expansion of the institute's industrial fellowship work in this period, as is shown by the funds received from donors to defray the cost of scientific investigations being conducted for these companies and associations. This money amounted to $632,547, an increase of $35,609 over the preceding year. The sum contributed by donors during the last twenty-five years totals $10,662,091.

At the close of the fiscal year 59 industrial fellowships (17 multiple and 42 individual fellowships) three more than the year before, were in operation. Each of these industrial fellowships was concerned with a major problem of technology, different in subject from the others. These industrial fellowships required the services of 86 fellows and 28 assistants. Thirty-one industrial fellowships have been at work for five years or more, and of these fellowships 1[illegible] have concluded 10 years of research, 10 have been operating for 15 years or more, and 4 fellowships are 20 years of age or older. The multiple industrial fellowship on petroleum refining has served its donor 25 years. It is clear from these data that the donors of the industrial fellowships alluded to recognize the need for and value of long-range basic production and merchandising researches. Throughout the fiscal year 1935–36, 66 industrial fellowships (19 multiple and 47 individual fellowships) were active, and 1[illegible] fellows and 69 assistants held posts thereon during all or part of the year. During the calendar year 1935 the contributions to the literature by members of the institute included 10 bulletins, 22 research reports, and 58 other papers. Thirty-four U. S. patents and 78 foreign patents were issued to fellows.

The year 1935–36 was characterized by many noteworthy advances through industrial fellowship research, chiefly a number of new products of commercial promise. Releasable facts relating to the investigational progress will now be summarized.

The importance of air conditioning induced the multiple industrial fellowship on heat insulation (R. H. Heilman, senior fellow, and R. W. Ortmiller) to investigate the various insulating materials used in the low-temperature field. The results of this research indicate that the conductivity of some low-temperature insulations is increased by more than 50 per cent. for an increase in temperature of only 100° F. In the high-temperature field, in studying refractory materials, the fellowship has found the emissivities of refractories of a number of different colors, concluding that the emissivity of light-colored refractories decreases rapidly with increase in temperature, the decrease starting at a temperature of about 400° F.

The industrial fellowship on illuminating glass, whose incumbent is Dr. R. R. McGregor, has devised novel methods for purifying glass-making materials and has carried forward work on two new types of opal glass for light-diffusing purposes.

R. C. Briant on the stone fellowship has evolved "Jetmar," an improved, interfused black marble, and has cooperated in the development of "Lumar," a scientifically selected, specially cut, translucent marble.

The principal activity of Dr. A. P. Thompson on the abrasives fellowship has been to serve in a liaison capacity between the donor's research laboratory and the industries in developing a series of novel refractories, named generically "Monofrax."

The industrial fellowship on natural gas, held by Dr. J. B. Garner, has been determining the utility of liquid normal butane as an industrial solvent and has also been studying the compressibility of natural gas.

The multiple industrial fellowship on organic synthesis, headed by Dr. E. W. Reid, has continued researches on the derivatives of ethylene diamine, morpholine, and piperazine. Applications have been found for propylene diamine and phenyl morpholine. A new resin, "Vinylite X," has been created for use in safety glass, and the resulting product has been proved to be quite superior in every respect to any other type of safety glass.

The incumbent of the industrial fellowship on paper, Dr. P. B. Davidson, learned that sucrose octa-acetate imparts to certain papers a mellow translucency that has suggested its use in specialty papers.

A new alloy steel particularly suitable for razor blades has been invented by E. J. Casselman on the shaving fellowship.

On the steel fellowship Dr. S. A. Braley has been carrying on with valuable results basic investigations in wire technology; he has also been largely responsible for the installation of a specification department in the donor's plant, to define all details of processing procedure for each and every wire requirement of customers.

Dr. R. N. Wenzel of the textile finishing fellowship conducted studies that have led to the manufacture of several new waterproofing agents for open fabrics.

In collaboration with the smoke abatement fellowship, the air pollution fellowship, whose incumbent is H. B. Meller, has made a preliminary research, using experimental animals, to determine the effects of mixtures of air with flue gases and accompanying solids. No definite conclusions have been reached, but there is evidence of the harmfulness of some of the air-diluted products of combustion of certain fuels, and a more scopeful investigation is being planned. These two fellowships have also made a comprehensive study of the effects of smoke on aviation.

Ten new industrial fellowships were put in operation during the fiscal year—soybean, glazing, meat merchandising, bone black, lead, protective coatings, air hygiene, food container, yeast and bone products. Another industrial fellowship, on household utilities, began work on March 2, 1936; and two other new industrial fellowships, on the utilization of silicate wastes and on problems in plate-glass technology, will have early inception. The following industrial fellowships concluded their research programs during the year: tire bead, starch, yeast production, petroleum production, food merchandising, zymology, and nitrogenous resins.

The year 1936 marks the decennial of the formation of the institute's department of research in pure chemistry, which is headed by Dr. L. H. Cretcher, aided by Dr. C. L. Butler, senior fellow. Throughout the year 1935–36 studies in the province of the cinchona alkaloids have been continued with the main object of securing compounds of therapeutic value in pneumonia. So far sixty-six preparations have been tested biologically by Drs. W. W. G. Maclachlan, H. H. Permar, J. M. Johnston, H. H. Burchell, and J. R. Kenny, the medical collaborators at Mercy Hospital, Pittsburgh. On the basis of favorable preliminary results, clinical studies have been carried out with apocupreine, ethylapocupreine and hydroxyethylapocupreine. The last-mentioned compound is the most promising drug that has been found to date. It has been tested in twenty-six clinical cases, and the findings have demonstrated a very high tolerance in the human to the drug, absence of any visual effects, and a high proportion of recoveries from severe pneumococcic infections of all types. Because of the great interest in hydroxyethylapocupreine and the difficulties involved in preparing it, considerable attention has been devoted during the year to the

investigation of this substance. Drs. B. L. Souther and Alice G. Renfrew and also Misses Mary Hostler and Mary A. Clapp have been active in this work.

In this department is a fellowship that is carrying on broad research on nutritional aspects of dental caries, under a grant from The Buhl Foundation of Pittsburgh. This extension of the study of the problem described last year is being conducted by Dr. G. J. Cox and two assistants. It is hoped that it will provide an answer to the interesting and important question, is there present in the diet during a critical period of tooth formation a factor that will aid in the construction of teeth resistant to decay?

For six years the institution has been supporting comprehensive research in the Institute of Pathology of the Western Pennsylvania Hospital in Pittsburgh, through arrangements made by Dr. C. B. Schildecker. This investigational work, which is being conducted by a group of scientists under the direction of Dr. R. R. Mellon, also relates in part to the treatment of pneumonia and allied pulmonary diseases and has resulted in the preparation of an apparently effective antipneumococcic serum. Late in 1935 members of this staff reported artificial breeding experiments with the tuberculosis bacillus that led to the discovery of a new form of this organism and shed new light on the disease. Then, too, progress has been made in an anti-streptococcic serum.

The new building of the institute, whose construction will soon be completed, is being gradually occupied. At present the department of research in pure chemistry and twelve industrial fellowships are located in this edifice.

W. A. HAMOR

MELLON INSTITUTE OF INDUSTRIAL RESEARCH

SPECIAL ARTICLES

INVASIVENESS OF SKIN INFECTIONS CAUSED BY PATHOGENIC FUNGI AND SUBSURFACE MYCELIUM[1]

THERE is little known with reference to the basic factors which determine chronicity and invasiveness of pathogenic fungi in skin infections. For this reason I have begun a study of the ability of pathogenic fungi to invade various solid mediums in an attempt to correlate these findings with what occurs in the body.

The invasiveness of pathogenic fungi for hair and skin has been amply demonstrated histologically. For this reason it seemed logical that a medium using as its source of nitrogen hydrolyzed hair and hydroylzed skin would be practicable. The Difco Laboratories prepared these products for me in the manner in which they prepare their peptone. The following mediums were used: 1 per cent. peptone, 4 per cent. dextrose, (Sabouraud's), 1½ per cent. agar; 1 per cent. hydrolyzed pig skin, 4 per cent. dextrose, 1½ per cent. agar; 1 per cent. hydrolyzed hair, 4 per cent. dextrose, 1½ per cent. agar. Plants were made using women's hydrolyzed hair, men's hydrolyzed hair and children's (before puberty) hydrolyzed hair. Children's hydrolyzed hair which was planted in duplicates was used for these descriptions. The pH was adjusted to 5.6. The tubes were incubated at room temperature in diffused light for a period of 30 days.

The following representative fungi and non-pathogenic fungus, *Scopulariopsis brevicaulis,* were planted in duplicate: *Achorion schoenleinii, Acladium castellani, Candida candida, Endodermophyton indicum, Endomyces capsulatus, E. dermatitidus, Epidermophyton cruris, E. inguinale, E. rubrum, Glenospora gammeli, Geotrichum bachmann, Indiella americana, Microsporon audouini, M. felineum, M. gypseum, Monosporum apiospermum, Monilia albicans, Oöspora humi, Sporotrichum schenkii, Trichophyton crateriforme, T. granulosum, T. gypseum, T. gypseum asteroides, T. gypseum lacticolor, T. interdigitale, T. louisiana, T. niveum, T. chophyton purpureum, T. sulfureum, Willia anomala.*

The following changes were noted. The growths in general became more subsurface on the skin medium and distinctly more subsurface on hair medium. In many instances there was complete loss of surface growth on hair medium. One could note the plate of growth (point of departure) successively deeper in skin and hair mediums. Coincidently the length and amount of surface mycelium and the roughness of the colony would become less or disappear. In most instances the plate of growth was distinct, but in a few this distinctness was lost so that the growth consisted only of mycelium, the breadth of which widened as the distance from the surface of the medium increased. The latter occurrence was noted only in hair medium.

The above findings suggested the possibility that cysteine might be a factor, since the amount of cysteine in hydrolyzed skin would be about one third to one fourth less than that in hydrolyzed hair. Cysteine hydrochloride was therefore substituted as the source of nitrogen, and it was found that the growths were very predominantly subsurface. This seemed surprising unless cysteine had to a considerable extent been

[1] Contribution No. 69 from the Department of Biology and Public Health, Massachusetts Institute of Technology, Cambridge, Mass.

oxidized to cystine, which is an excellent carrier of oxygen.

It is possible that cysteine-cystine or a derivative is responsible for the subsurface growth. That oxidation-reduction is important seems likely, since when 0.001 per cent. methylene blue or 0.002 per cent. indigo carmine is added to the cysteine-cystine stab medium and autoclaved, directly on removal no color is apparent. Immediately on standing a deep blue dye line of about a millimeter is noted on the surface. Some color diffuses from the dye line into the medium to impart to it a light blue color. On standing overnight the dye line sinks into the medium about 1½ centimeters, the color below it disappears, and that above is a lighter blue. The color above the dye line fades apparently more rapidly than that of the dye line. In time color sinks below the dye line. There is some fading. If the concentration of the dye is increased the color is increased above and below the dye line. The organisms studied grew above this dye line, but when stabs were made to a depth below it none or very little growth was obtained (the dye was not added to the medium in which the organisms were grown). An extended study of the dye line will be the subject of a future paper.

I hope to correlate the above observations with disease and invasiveness of skin fungi and factors which make invasion of microorganisms and chronicity probable. That this is possible seems evident when we consider some of the factors of importance in inflammation. There is increase of acidity, splitting of moieties with some of the split products evidently in reduced form, and increase in the number of ions with resultant increase in osmotic pressure. The host attempts to neutralize the excess acidity and in so doing increases the activity of reduced forms as reducing substances. This decreases oxygen tension and may be responsible in part of increased oxygen carriage to the part. We know that sulphydryls are important constituents of living tissues and from the work of Hammett and co-workers, published in the recent issues of *Protoplasma,* that the reduced sulphydryls ("wound hormone") stimulate mitoses. It is probable that the reduced sulphydryl is one of the most active reducing agents in living tissue and is an important factor in the mitoses of inflammation. In chronic inflammation the above reactions probably occur in minor degree, dependent upon the immune reaction of the host. The importance of enzymes can not be denied, but there is danger of overemphasizing these entities, the nature of which is unknown, and thereby overlooking features otherwise evident. One can not deny that the trigger to the above reactions is the initial injury which by disrupting and destroying cells apparently liberates substances which catalyze reactions elaborating products which stimulate the compensatory mechanism of the host. In future work I hope to add light to the above subject.

JOHN W. WILLIAMS

GLUTATHIONE AND ASCORBIC ACID

THE reversibly oxidized form of ascorbic acid (Vitamin C) possesses the same antiscorbutic potency as the reduced form of the vitamin, whether administered *per os* or subcutaneously. Comparisons in feeding experiments with suboptimal doses of the vitamin showed that the antiscorbutic potency of a solution of the oxidized vitamin was equal to the quantity of oxidized ascorbic acid which can be converted to the reduced form by H_2S in acid solution.

From pH 5.5 upwards at 37° C. the reversibly oxidized form undergoes an irreversible change, whereby it loses its antiscorbutic potency and the property of convertibility to the reduced form by H_2S. This change is not an oxidation. It proceeds as quickly *in vacuo* as in contact with air.

Since this irreversible change proceeds quickly at pH 7.4, the antiscorbutic potency of the reversible oxidized form indicates that it is protected from this change *in vivo*. Experiments on the blood and urine and tissue slices of animals showed that this protective action consists in the reduction of the reversible oxidized vitamin.

This reduction can be effected rapidly by glutathione when it is present in sufficiently high concentration—100 to 200 mg per cent.—as it is in such animal tissues as the liver and adrenal. Thus at pH 7.0 and 37° C., in approximately equimolar concentrations of glutathione and ascorbic acid, only 2 per cent. of the reversibly oxidized ascorbic acid (initial concentration 4 mg per cent.) was reduced in 4 hours, a 7.5 fold concentration of glutathione effected a reduction of 40 per cent., a 12.5 fold concentration 65 per cent., and a 25 fold concentration 95 per cent. reduction in the same length of time.

However, the absolute concentration of glutathione rather than its relative excess over that of ascorbic acid is more important in the physiological range of ascorbic acid concentration. With 200 mg per cent. glutathione at pH 7.0, 50 per cent. of the ascorbic acid is reduced in five minutes, about 80 per cent. in fifteen minutes with ascorbic acid concentrations ranging from 4 to 25 mg per cent.

This reaction between glutathione and oxidized ascorbic acid possesses several interesting features. It reveals an important function of glutathione in animal tissues. It proceeds sufficiently rapidly not to require an enzyme—though an enzyme mechanism in addition is not excluded. It shows the great importance of the concentrations of the reactants on the rate of a biological oxidation.

These experiments with glutathione and ascorbic

acid were carried out with a vacuum technique. The failure of previous workers to observe any significant amount of reduction of ascorbic acid by glutathione is to be ascribed to their having worked at too low a pH level and without a sufficient excess of glutathione over ascorbic acid.

H. BORSOOK
C. E. P. JEFFREYS
CALIFORNIA INSTITUTE OF TECHNOLOGY

SCIENTIFIC APPARATUS AND LABORATORY METHODS

A SIMPLE COMBINATION OF CONTINUOUS EXTRACTOR AND EXTRACT-WASHER

IN organic and biochemical laboratories the extraction of liquids with lighter organic solvents and the subsequent washing of the extract with aqueous solutions are very common operations. Yet, continuous extractors for this purpose are used comparatively rarely, although several are on the market. We suspect the reason for this is the expense and complexity of the apparatus available at present. Automatic extract-washers are almost never used.

We have devised a simple automatic extractor-washer combination which can be made from the usual laboratory glassware with the ordinary glass-blowing equipment. All materials are of Pyrex glass and include a 500 cc Kjeldahl flask, a large test-tube (about 400 × 50 mm), a 250 cc Erlenmeyer flask and glass tubing. The assembled apparatus is illustrated in Fig. 1. *A* is the extraction flask—any size Kjeldahl flask may be used to which the side arm is sealed as indicated. This is filled to the neck with the solution which is to be extracted. *B* is the extract-washer, made from a large test-tube by sealing on the side arm. This tube is filled with the solution to be used for washing the organic solvent. *C* is the Erlenmeyer flask and contains the lighter solvent. *D* is a tin can lined with asbestos paper and contains a 75-watt bulb.

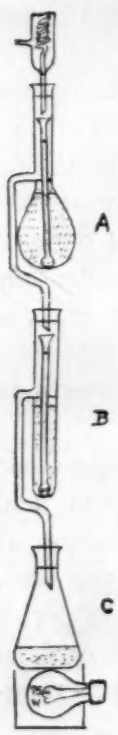

FIG. 1.

The small holes at the lower ends of the inner tubes which provide a fine spray of the solvent may be made readily from a strand of wire taken from a chromel wire gauze (A. H. Thomas Co.: Catalog No. 9993), which is sharpened to a fine point and held in a pliers or sealed into a glass rod. The glass bulb and pointed wire are heated with a fine pin-point blow-torch flame and, with a little practice, fine holes are easily punched. The upper ends of the inner tubes are flanged out with a carbon from an arc lamp.

The solvent head in the inner tube necessary to overcome the hydrostatic pressure of the aqueous solution may be calculated from the specific gravities of the respective liquids and the height of the aqueous solution.

We have used this apparatus for the extraction of oestrin from pregnancy urine with ether. However, any immiscible solvent may be used which is lighter than the liquid to be extracted. We have also used benzene, in which case the 75-watt bulb is replaced with an electric hot plate.

The great advantage of this apparatus is that it prevents completely the formation of emulsions which, a glance at the oestrin literature will show, are so common when urine is shaken with ether in a separatory funnel. The washer, as we use it, is filled with sodium carbonate solution and automatically removes acidic constituents from the ether extract. It is obvious that any type of washing solution and any number of washers may be inserted.

The apparatus is efficient, giving a very thorough extraction of oestrin from a 24-hour human pregnancy urine when allowed to run over night.

The apparatus can be made even more convenient, if it is desirable to use it very often, by replacing the cork connections with ground-glass joints.

H. BOYD WYLIE
M. J. SCHMULOVITZ,
Weaver Fellow in Biological Chemistry
UNIVERSITY OF MARYLAND
MEDICAL SCHOOL

BOOKS RECEIVED

COLLINS, FRANCIS A. *The Boys' Book of Model Aeroplanes.* Third edition, revised. Pp. vii + 262. Illustrated. Appleton-Century. $2.00.

DICKINSON, H. W. *James Watt, Craftsman and Engineer.* Pp. xiii + 207. 14 figures. 17 plates. Cambridge University Press, Macmillan. $4.00.

FOSTER, WILLIAM. *The Romance of Chemistry.* Second edition, revised. Pp. xviii + 497. Illustrated. Appleton-Century. $3.00.

LUGN, A. L. *The Pleistocene Geology of Nebraska.* Bulletin No. 10, Second Series, of the Nebraska Geological Survey, 1935. Pp. 223. 38 figures. The Survey.

MEYER, ARTHUR W. *An Analysis of the "De Generatione Animalium" of William Harvey.* Pp. xx + 167. Stanford University Press. $3.00.

Science Reports of the Tôhoku Imperial University, Sendai, Japan. Second Series (Geology). Vol. XVIII, No. 3. Pp. 44. 11 plates. Maruzen Company, Tokyo and Sendai.

VAN UVEN, M. J. *Mathematical Treatment of the Results of Agricultural and Other Experiments.* Pp. vi + 309. P. Noordhoff N. V. Groningen-Batavia.